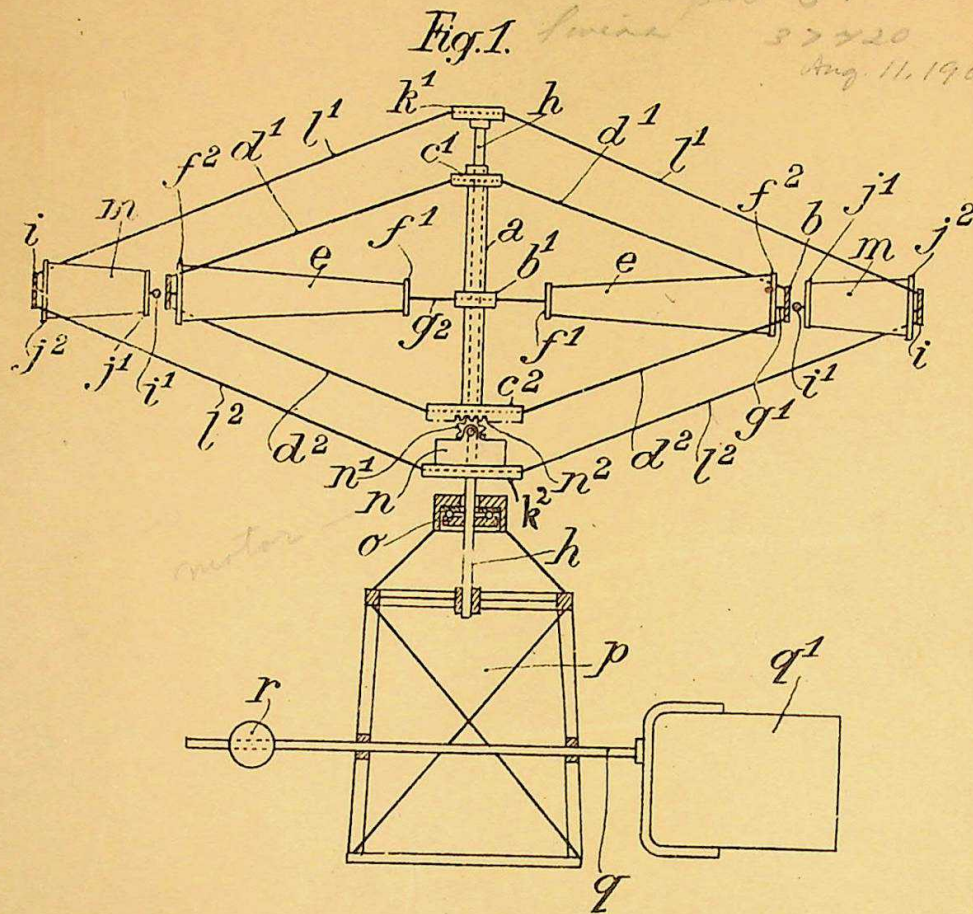


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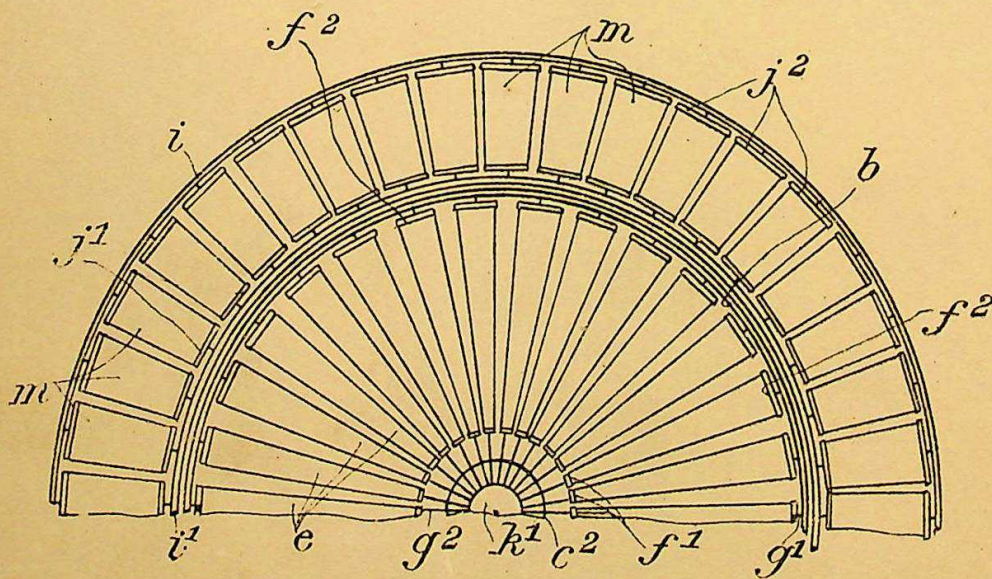
A.D. 1907. AUG. 10. N<sup>o</sup> 18,158.  
FROSSARD'S COMPLETE SPECIFICATION.

(1 SHEET)

170-135.28



*Fig. 2.*





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2  
A.D. 1907

*(Under International Convention.)*

Date claimed for Patent under Patents Act, 1901, }  
being date of first Foreign Application } 11th Aug., 1903  
(in Switzerland),

Date of Application (in the United Kingdom), 10th Aug., 1907

At the expiration of twelve months from the date of the first Foreign Application,  
the provision of Section 1 (2) of the Patents Act, 1901, as to inspection of  
Specification, became operative

Accepted, 7th Nov., 1907

#### COMPLETE SPECIFICATION.

##### "Improvements in or relating to Flying Machines"

I, JOSEPH FROSSARD, Gentleman, of Avenue de la Gare, Porrentruy, Switzerland, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

5 It has been already attempted in various circumstances, more particularly for the control or propulsion of flying apparatus, to use screw propellers arranged one behind another and rotating in opposite directions about one and the same spindle. This arrangement which seems to give very good results, gives in  
10 reality only moderate results; it presents in fact two very important disadvantages.

First of all, in view of the fact that the operative surface of the propellers is restricted to that of their arms, it is necessary to drive the said propellers at a comparatively enormous speed in order to get out of them practically useful work. Further there is a considerable loss in the efficiency of the propellers, due to the fact that each interferes with the action of the other. This  
15 phenomenon is specially noticeable as regards flying apparatus in helicopteres with superposed propellers: the upper propeller projects air on the bottom propeller and thus partly paralyses its effect, whilst the bottom-propeller removes a portion of the air on which the upper propeller ought to have acted.

20 As a remedy for the above state of things, it has been proposed to construct flying machines wherein two driving wheels fashioned after the manner of cycle wheels, have been employed, and mounted in the same axial plane, and my invention relates to an improved form or arrangement of such apparatus.

In the accompanying drawing the invention is shown applied by way of  
25 example to a special helicoptere which is diagrammatically indicated; partly in vertical section and partly in elevation in Figure 1, and partly in plan in Figure 2.

The smaller of the concentric wheels comprises a hub *a* and a rim *b* connected to two cheeks or flanges *c*<sup>1</sup> *c*<sup>2</sup> by spokes *d*<sup>1</sup> *d*<sup>2</sup>. It comprises, moreover, paddles  
30 or blades *e* connected on the one hand by means of wires or ties *g*<sup>1</sup> to the rim *b*



*Frossard's Improvements in or relating to Flying Machines.*

and on the other hand by means of ties  $g^2$  to an additional flange  $b^1$  of the hub  $a$  or to an inner ring similar to that shown at  $i^1$  and which will be hereinafter referred to.

The second larger wheel comprises a spindle  $h$  on which rotates the hub  $a$  and a rim  $i$  connected to two flanges  $k^1$  and  $k^2$  by spokes  $l^1$   $l^2$ . It comprises, moreover, paddles or blades  $m$  held between the rim  $i$  and an inner ring  $i^1$ .

The blades  $c$  and  $m$  are preferably constituted by an aluminium body limited at its ends by wooden parts such as shown at  $f^1$  and  $f^2$  and at  $j^1$  and  $j^2$ . They are held at a desired angle in any suitable manner, for instance by means of small ties secured to the rim, or by means of a system enabling their inclination to be varied during the travelling.

The movement is given to the said two wheels by means of a motor  $n$  diagrammatically shown in the drawing, and mounted on one of the two wheels (in the construction illustrated on the larger wheel), the said motor acting on the other wheel by suitable means for instance, of a pinion  $n^1$  engaging with a toothed ring  $n^2$ . Owing to this construction the effort of the motor is distributed between the two wheels: it tries to rotate in a certain direction the wheel on which it is not mounted. This wheel having to overcome resistance, reacts in its turn on the motor and forces it and the wheel which carries it to rotate in the opposite direction.

The division of the effort of the motor on the two wheels depends, as will be readily understood on the dimensions of the blades, their inclination and number which factors are generally different for the two wheels.

The car can be advantageously made of a kind of cage  $p$  suspended by means of a ball bearing  $o$  to the spindle  $h$  and provided on the one hand with a rudder  $q^1$  and on the other with an adjustable balance weight  $r$  the support for which can be formed by the rod  $q$  of the rudder.

By shifting the said balance weight  $r$  or by the traveller himself moving in the car the centre of gravity of the apparatus can be shifted.

By bringing the centre of gravity of the apparatus outside the axis of the spindle  $h$ , the apparatus will no longer make a purely vertical movement but oblique movements, the horizontal component of which will correspond to the horizontally travelled path.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is:—

The complete helicoptere substantially as described or illustrated in the accompanying drawing.

Dated this 10th day of August 1907.

BOULT, WADE & TENNANT,  
London Agents.